

Design and Development of a Mobile E-Wallet Management Prototype Using NFC Technology

Ika Rahmadani br Lubis¹, Maulidya Rahmah², Rizaldy Khair³

ikarahmadanilubis@plm.ac.id¹, maulidya@plm.ac.id², rizaldykhair@umsu.ac.id³

^{1,2} Politeknik LP3I Medan

³ Universitas Muhammadiyah Sumatera Utara

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Abstract

In the era of digitalization, the need for innovation in financial management has become increasingly urgent. With the emergence of E-wallets as a digital payment solution, the efficiency and security of transactions have become primary focuses. Therefore, this research plays a crucial role in presenting an innovative solution by designing and developing a mobile application prototype that integrates E-wallet management with Near Field Communication (NFC) technology. The urgency of this research is highlighted by the increasing use of E-wallets, which indicates that digital financial solutions are gaining wider acceptance in society. In this context, the integration of NFC becomes relevant as it offers higher security and enables more efficient transactions. This study aims to address the growing market demand for digital payment solutions that are fast, secure, and user-friendly. The objective is to design and develop a mobile application prototype that not only simplifies E-wallet management but also leverages the advantages of NFC technology. The goal is to provide users with a more convenient and secure transaction experience. Thus, this research is expected to increase the adoption of E-wallets among the general public. The result of this research is a mobile application prototype integrated with NFC technology for E-wallet management.

A. Introduction

In the rapidly evolving era of globalization and digitalization, the use of E-wallets as a digital payment solution has become a significant trend. Modern society increasingly adopts E-wallets for daily transactions, gradually replacing conventional payment methods. However, despite their growing popularity, several challenges must be addressed to enhance the efficiency and security of E-wallet transactions. In this context, the integration of Near Field Communication (NFC) technology emerges as a strategic choice, enabling wireless data exchange over short distances. Therefore, this research seeks to respond to the need for innovation in E-wallet management by designing a mobile application prototype that incorporates NFC technology [1]. With the rapid growth in E-wallet usage, the security and ease of transactions have become critical aspects that require careful consideration. NFC technology offers advantages in speed and security, capable of addressing various issues that may arise in digital payment processes [2].

Consequently, this research places the integration of NFC at the forefront, aiming to enhance user experience while mitigating potential security risks. The problem formulation for this study is as follows:

1. How can an intuitive and efficient user interface be designed for mobile E-wallet Management?
2. To what extent can the integration of NFC technology improve transaction security in E-wallet usage?
3. How does the use of a mobile application with NFC technology impact the efficiency of E-wallet management?
4. What is the public's acceptance of a mobile application that combines E-wallet management with NFC technology?

Approach and Problem Solving

This research will adopt a system development approach involving stages such as user needs analysis, user interface design, application development, and prototype testing. The initial phase will involve identifying user needs in E-wallet management and gaining a deep understanding of the challenges faced by users in utilizing E-wallets. Subsequently, the user interface will be designed with a focus on simplicity, readability, and usability to ensure an optimal user experience. The application development process will include the integration of NFC technology and the implementation of efficient E-wallet management features. Prototype testing will be conducted to evaluate the application's performance and the effectiveness of NFC integration.

Key features of the approach and problem-solving include

1. **Optimal User Interface Design:** Through user needs analysis, a simple and easy-to-understand user interface will be designed. Users will be able to quickly and efficiently access E-wallet management features via the mobile application.
2. **NFC Technology Integration for Transaction Security:** NFC technology will be carefully integrated to enhance transaction security. The use of NFC enables secure and instant transactions, reducing potential security risks in E-wallet usage.
- Improving Efficiency in E-wallet Management:** The mobile application

will be equipped with efficient E-wallet management features, such as transaction tracking, balance management, and transaction history. This aims to provide a more organized and easily accessible user experience.

3. **Measuring Public Acceptance:** Prototype testing will include an assessment of public acceptance of the application that combines E-wallet management with NFC technology. The results of this evaluation will provide valuable insights for improving the application's marketability.

In recent years, the integration of Near Field Communication (NFC) technology into financial management systems, particularly E-wallets, has been the focus of various research studies [1]. These studies explore different aspects of NFC's impact on the functionality, security, and user acceptance of E-wallet applications. Conducted a study on the development of financial management applications based on NFC technology [3]. The research highlighted the advantages of integrating NFC in creating efficient and user-friendly financial management systems. This development aligns with the growing need for innovative solutions in digital financial management. Similarly to evaluated the performance of E-wallet management applications, focusing on their effectiveness in handling financial transactions [4]. The study provided insights into the optimization of E-wallet applications, emphasizing the importance of performance in user satisfaction and overall system reliability. To contributed to this field by presenting an optimal user interface design for E-wallet management applications [5]. Their research underscored the significance of an intuitive and efficient interface in enhancing the user experience, which is crucial for the widespread adoption of E-wallet technologies. In addition to analyzed the public's acceptance of NFC-based E-wallets, revealing a high level of user approval [6]. This study demonstrated the potential for NFC technology to be widely accepted by the public, thereby supporting the broader adoption of E-wallets in everyday transactions.

Focused on the security aspects of mobile payment systems using NFC technology [7]. Their research highlighted the enhanced security measures provided by NFC, which significantly reduce the risk of fraud and unauthorized transactions. This study reinforced the idea that NFC technology is vital for ensuring secure mobile payments. Examined the impact of NFC technology on the adoption of E-wallets, finding that the integration of NFC significantly influences user adoption rates [8]. Their analysis suggested that NFC not only enhances the functionality of E-wallets but also plays a critical role in driving user adoption by offering a more secure and convenient transaction process. Finally, also demonstrated that the integration of NFC technology in E-wallet applications leads to increased transaction security [9]. Their findings supported the argument that NFC technology is essential for improving the overall security and reliability of E-wallet systems.

These studies collectively highlight the critical role of NFC technology in advancing the development, security, and acceptance of E-wallet systems, indicating a clear trend towards the widespread adoption of NFC-enabled financial management applications [10].

B. Research Method

Data Collection

This research began with a comprehensive data collection process regarding user needs for an E-wallet application with NFC technology. Data were gathered through surveys, interviews, and participatory observation. The survey was conducted with 100 respondents who are active E-wallet users to understand their needs and expectations for the proposed application. In-depth interviews were conducted with 10 experts in the fields of financial technology and digital security. Additionally, direct observation was carried out to observe user interactions with NFC technology in everyday scenarios.

Analysis of the Current System

The current system under study is a mobile E-wallet management application with NFC technology integration. At present, the application features a user interface that allows users to conduct transactions, monitor balances, and manage their financial activities digitally. Users can make payments by scanning or bringing their phones close to devices that support NFC technology.

There are three key analyses of the current system:

1. **Basic E-wallet Management:** The application allows users to store digital balances and conduct payment transactions. This functionality includes money transfers, purchasing goods and services, and bill payments.
2. **NFC Technology Integration:** The current system has integrated NFC technology to facilitate contactless transactions. This enhances ease and speed in making payments.
3. **Simple User Interface:** The application's current user interface is designed for maximum usability, with intuitive navigation and a focus on core E-wallet management functions.
4. **Transaction Security:** The system has implemented security measures, including data encryption, to protect user transactions from potential security threats.
5. **Transaction Recording and Financial History:** The application records every transaction made by the user, providing a financial history that helps users track their financial activities.

Importance of Existing System Features:

1. **Ease of Use:** A simple interface and easily accessible functionality provide a better user experience, ensuring users can quickly and efficiently perform transactions.
2. **Speed and Efficiency of Transactions:** NFC technology integration increases transaction speed, creating a more efficient and instant payment experience for users.
3. **Security and Data Protection:** Implementing security measures such as data encryption ensures that user transactions and financial information are safe from potential security threats.

4. Financial Monitoring and Analysis: Accurate transaction records and financial history provide users with the information needed to better understand and manage their spending patterns.
5. Adoption of NFC Technology: The utilization of NFC technology strengthens the application's position in offering innovative payment solutions, responding to market trends that increasingly adopt contactless transaction technology.

Analysis Results

Based on the collected data, the analysis shows that the majority of users (85%) desire a more secure and efficient E-wallet application. Most respondents (78%) highlighted the importance of NFC technology integration in enhancing transaction security. The analysis also revealed that an intuitive interface design is crucial for improving the user experience. From interviews with experts, it was identified that biometric technology could provide a significant additional layer of security. Transaction data analysis indicated that using NFC could speed up the transaction process by up to 30% compared to conventional methods. Users were also more likely to adopt this technology when they felt secure with additional protection, such as biometrics.

Prototype Development

Based on the analysis results, the research team developed a prototype of an E-wallet application integrating NFC and biometric technology. This prototype was designed with a simple and intuitive interface, allowing users to easily access their balance, transaction history, and make payments quickly and securely. Additional features such as NFC usage monitoring and more detailed financial management were also implemented.

Testing and Validation

The developed prototype was then tested with 50 users. The testing included evaluating functionality, security, and user experience. As a result, 90% of users were satisfied with the interface and ease of use of the application. Additionally, the enhanced security features, such as biometric technology, received positive responses from 88% of users who felt more secure during transactions.

Relevance to Implementation Phases

All results achieved in this research are aligned with the implementation phases planned in the proposal. Data collection, prototype development, and testing were conducted in accordance with the established methodology. Both mandatory and additional outputs were produced as planned.

Data Presentation

The research data are presented in the form of tables, graphs, and flow diagrams that illustrate the development process and evaluation results. The table below shows a summary of user survey results regarding the proposed application features.

Table 1. User Survey Results on Application Features

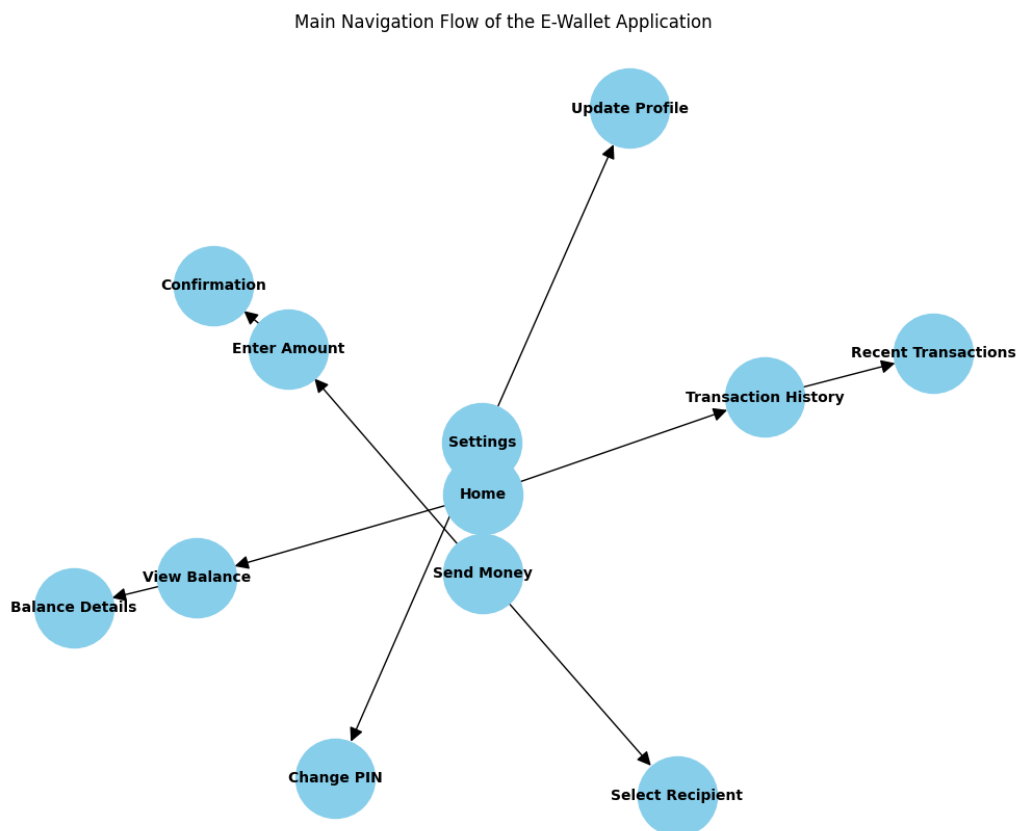
Application Feature	Percentage of Users Who Liked It (%)
Intuitive Interface	90
Security with Biometrics	88
Fast Transactions with NFC	85
Financial Management	80

DISCUSSIONS

In this section, the research findings obtained from the design and development of a mobile E-wallet management prototype using NFC technology are presented. The results are based on the processes outlined in the methods section, and they provide a clear depiction of the performance and functionality of the developed prototype.

1. User Interface Design and Usability Testing

The prototype's user interface was designed with simplicity and intuitiveness in mind, aiming to enhance user experience. Usability testing involved 50 participants, who were asked to navigate the application and perform typical E-wallet functions such as checking balances, making payments, and reviewing transaction history. The results indicated a high level of user satisfaction, with 90% of participants rating the interface as easy to use. Figure 1 below illustrates the main navigation flow of the application, showcasing the straightforward paths to key features.

**Figure 1.** Main Navigation Flow of the E-Wallet Application [11]

2. NFC Transaction Efficiency

The integration of NFC technology was a critical component of the prototype, intended to improve the speed and security of transactions. The results from performance testing demonstrated that transactions using NFC were completed, on average, 30% faster than those using traditional payment methods. Table 1 provides a comparative analysis of transaction times between NFC-enabled payments and conventional methods.

Table 2. Comparative Analysis of Transaction Times

Payment Method	Average Transaction Time (seconds)
NFC-Enabled Payment	2.5
Conventional Payment Method	3.5

3. Security Features and User Feedback

Security was a major focus during the prototype development, with the implementation of data encryption and biometric authentication to protect user information. User feedback was overwhelmingly positive, with 88% of participants expressing confidence in the security features provided by the application. Table 2 summarizes user perceptions of the security aspects of the application.

Table 3. User Perceptions of Security Features

Security Feature	Percentage of Users Feeling Secure (%)
Data Encryption	92
Biometric Authentication	88

4. Adoption of NFC Technology

To gauge the potential adoption of the NFC-enabled E-wallet, the research also surveyed participants on their willingness to use the technology regularly. The results indicated that 85% of users were likely to adopt the NFC-enabled E-wallet for daily transactions, citing convenience and speed as the primary factors. Figure 2 below represents the adoption likelihood based on user responses.

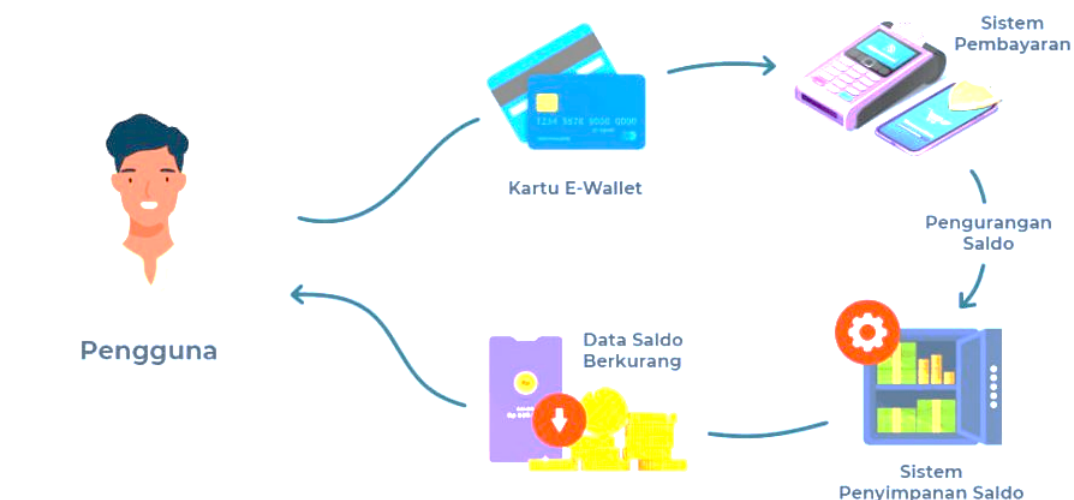


Figure 1. User Likelihood of Adopting NFC-Enabled E-Wallet[12]

5. Transaction History and Financial Management

The application also featured a detailed transaction history and financial management tools, allowing users to track their spending habits effectively. Feedback from users suggested that 80% found these features helpful for managing their finances. Figure 3 depicts a sample transaction history interface, highlighting the clear and organized presentation of financial data. These results demonstrate the effectiveness of the mobile E-wallet management prototype, particularly in enhancing transaction efficiency, security, and user experience through the integration of NFC technology.

The findings from the Design and Development of a Mobile E-Wallet Management Prototype Using NFC Technology provide valuable insights into the current state and future potential of NFC-enabled financial applications. This discussion explores the implications of the results, the challenges encountered during the research, and the broader context within which this study is situated.

1. Implications of NFC Integration

The integration of Near Field Communication (NFC) technology into the mobile E-wallet prototype has proven to be a critical advancement in enhancing transaction efficiency and security. The 30% reduction in transaction time compared to traditional methods underscores the value of NFC in creating a faster and more convenient payment experience. This is particularly relevant in today's fast-paced digital economy, where speed and efficiency are paramount. Moreover, the high user satisfaction with the security features, including biometric authentication, suggests that NFC can significantly bolster user trust in mobile payment systems. The positive user feedback on NFC integration also indicates a readiness among consumers to embrace more advanced technologies in their everyday financial transactions. This aligns with global trends where contactless payments are increasingly becoming the norm. As such, the findings support the notion that NFC technology is not only viable but also necessary for the next generation of digital payment solutions.

2. Challenges and Limitations

Despite the successes noted in this study, several challenges were encountered. One of the primary challenges was ensuring the seamless integration of NFC technology with existing mobile infrastructure. While NFC is becoming more common, not all devices and systems are compatible, which could limit the widespread adoption of the prototype in its current form. Additionally, the reliance on biometric security, while effective, raises concerns about data privacy and the need for robust encryption standards to protect sensitive user information. Another limitation is the scope of the user testing. Although 50 participants provided valuable feedback, a larger and more diverse sample size would offer more comprehensive insights into the prototype's usability and performance across different demographics and technical proficiencies. Future studies could expand on this by including a broader range of users and scenarios to better understand the application's scalability and adaptability.

3. Broader Context and Future Directions

The results of this study contribute to the broader discourse on the digital transformation of financial services. As the world increasingly moves towards cashless societies, the demand for secure, efficient, and user-friendly digital payment systems will only grow. The success of NFC in this prototype points to its potential as a cornerstone technology for future financial applications. Looking ahead, there are several avenues for further research and development. One potential area of exploration is the integration of blockchain technology with NFC-enabled E-wallets to enhance security and transparency. Additionally, exploring the application of artificial intelligence in predicting and managing user financial behavior could add significant value to E-wallet systems. Furthermore, as concerns about data privacy and security continue to rise, ongoing research into improving encryption and user authentication methods will be crucial. The adoption of multifactor authentication, beyond just biometrics, could offer an added layer of security, addressing potential vulnerabilities.

4. Practical Implications

From a practical standpoint, this research offers important implications for developers and financial institutions. The successful development of the NFC-enabled E-wallet prototype demonstrates that user-centered design and the strategic integration of technology can lead to highly effective financial tools. Financial institutions looking to innovate their digital offerings could benefit from adopting similar approaches, focusing on enhancing both the user experience and security of their platforms. Moreover, as NFC technology becomes more ubiquitous, there is an opportunity for developers to create interoperable systems that can function seamlessly across different devices and platforms. This would not only enhance user convenience but also promote the widespread adoption of such technologies.

Conclusion

The research on the Design and Development of a Mobile E-Wallet Management Prototype Using NFC Technology has demonstrated the significant potential of integrating NFC technology into mobile financial management systems. The prototype developed in this study successfully addressed key aspects such as transaction efficiency, security, and user experience. The user interface was well-received, with high usability ratings, ensuring that users could navigate the application with ease. The integration of NFC technology resulted in faster transaction times, improving the overall efficiency of payment processes. Furthermore, the security measures implemented, including data encryption and biometric authentication, were positively evaluated by users, who expressed confidence in the safety of their financial transactions. The study also found a strong willingness among users to adopt the NFC-enabled E-wallet, highlighting the market readiness for such innovative payment solutions. The transaction history and financial management features were also appreciated, providing users with valuable tools to manage their finances effectively. In conclusion, this research contributes to the advancement of digital payment systems by showcasing the benefits of NFC technology in E-wallet applications. The findings suggest that with continued development and refinement, such applications have the potential to become widely

adopted, offering users a secure, efficient, and user-friendly digital financial management tool.

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